



SNS COLLEGE OF ENGINEERING

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AN AUTONOMOUS INSTITUTION



Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

23MCT003 – ENVIRONMENTAL SCIENCE & SUSTAINABILITY

1. ENVIRONMENT AND BIODIVERSITY

1.2 - ECO-SYSTEM AND ENERGY FLOW– ECOLOGICAL SUCCESSION

Ecosystem and Energy Flow

Definition of Ecosystem:

An ecosystem is a community of living organisms (plants, animals, and microorganisms) interacting with each other and their non-living (abiotic) environment (air, water, soil). This interaction forms a complex network through which energy and nutrients flow, allowing life to be sustained within the system.

Components of an Ecosystem:

1. Biotic Components:

- Producers: Also known as autotrophs, these organisms (primarily plants and algae) produce their own food through photosynthesis, using sunlight, carbon dioxide, and water.
- Consumers: These are heterotrophic organisms that depend on other organisms for food. They are classified into:
 - ✓ Primary Consumers: Herbivores that eat producers (e.g., deer, rabbits).
 - ✓ Secondary Consumers: Carnivores that eat primary consumers (e.g., wolves, snakes).
 - ✓ Tertiary Consumers: Higher-level carnivores that eat secondary consumers (e.g., eagles, sharks).
 - ✓ Omnivores: Organisms that consume both plants and animals (e.g., humans, bears).
- Decomposers: Organisms such as bacteria and fungi that break down dead organic matter, returning nutrients to the soil.

2. Abiotic Components:

- Physical factors: Climate, temperature, sunlight, and soil type.
- Chemical factors: Nutrients, water, and gases like oxygen and carbon dioxide.

Energy Flow in an Ecosystem:

Energy flow in an ecosystem is a unidirectional process, beginning with the input of solar energy and moving through different trophic levels.

1. **Primary Source of Energy:** The Sun is the primary source of energy in most ecosystems. Plants capture solar energy through photosynthesis and convert it into chemical energy stored in glucose.
2. **Trophic Levels:**
 - ✓ **First Trophic Level:** Producers (plants and algae) form the base of the ecosystem's energy pyramid.
 - ✓ **Second Trophic Level:** Primary consumers (herbivores) consume the producers.
 - ✓ **Third Trophic Level:** Secondary consumers (carnivores) eat the primary consumers.
 - ✓ **Fourth Trophic Level:** Tertiary consumers feed on secondary consumers.
3. **Energy Transfer:** Energy is transferred from one trophic level to the next, but only about 10% of the energy is passed on, while the rest is lost as heat through metabolic processes. This is known as the 10% law of energy transfer.
4. **Energy Pyramid:** This concept illustrates the decreasing amount of energy available at successive trophic levels, with producers having the most energy and top predators having the least.

Ecological Succession

Ecological succession is the process by which the structure of a biological community evolves over time. There are two main types of succession:

1. **Primary Succession:**
 - **Definition:** Primary succession occurs in lifeless areas where there is no soil, such as after a volcanic eruption, glacial retreat, or on newly formed sand dunes.
 - **Process:**
 - ✓ **Pioneer Species:** The first organisms to colonize the barren area are usually hardy species like lichens and mosses, which can survive in harsh conditions and begin the soil formation process.

- ✓ Soil Formation: As pioneer species break down rocks and organic matter accumulates, soil starts to form, allowing more complex plants like grasses and shrubs to grow.
- ✓ Climax Community: Over time, a stable and mature ecosystem, known as a climax community, develops, consisting of complex plant and animal species. This stage represents a stable, balanced ecosystem that can sustain itself unless disrupted.

2. Secondary Succession:

- Definition: Secondary succession occurs in areas where an existing community has been disturbed or destroyed but where soil remains, such as after a forest fire, flood, or human activities like farming.
- Process:
 - ✓ Initial Colonization: Grasses, herbs, and other fast-growing plants are the first to colonize the disturbed area.
 - ✓ Intermediate Stages: Shrubs and small trees begin to grow, followed by larger trees as the ecosystem progresses.
 - ✓ Climax Community: Eventually, the ecosystem reaches a climax community similar to what existed before the disturbance.

Importance of Ecological Succession:

- Biodiversity: Succession leads to increased biodiversity as different species colonize the area at different stages.
- Habitat Formation: Succession creates a variety of habitats, supporting different species and promoting ecosystem stability.
- Ecosystem Recovery: Succession is a natural process that allows ecosystems to recover from disturbances and maintain ecological balance.
- Soil Formation and Stabilization: Primary succession is crucial for soil formation in new or barren areas, while secondary succession helps in soil stabilization after disturbances.

In summary, ecosystems are dynamic entities that depend on energy flow and the gradual process of ecological succession to maintain balance and support life. Understanding these processes is crucial for conservation efforts and ensuring the sustainability of our natural environment.